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ABSTRACT

This study of eighth graders investigates the effects of Kindergarten attendance on (1) Basic Skills Test (BST) performance and (2) the incidence of grade retention (non-promotion). To accomplish the first purpose, over 64,000 eighth grade pupils in the public schools of Tennessee were administered the BST. On each answer sheet of the BST pupils were asked to indicate whether they had attended kindergarten or not and their scores on the BST's four sub-tests (mathematics, spelling, language, and reading) were collected. To accomplish the second purpose of this study, data were obtained from a separate research study. Subjects were believed to be comparable with respect to achievement in basic skills and to kindergarten attendance to the sample of the present study. Nearly 6,000 pupils in grades 5 to 8 were selected from 48 schools on the basis of their mathematic achievement scores. The results from the BST demonstrated that achievement of pupils with kindergarten background was superior to that of non-kindergarten pupils in mathematics, spelling, language and reading. The effect was greatest for mathematics and language, and less for reading and spelling. Results from the study of mathematics achievement revealed that the incidence of retention in grade is considerably less for pupils with kindergarten experience than pupils without it. (Author/MP)

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A COMPARISON OF GRADE RETENTION AND OF BASIC SKILLS TEST SCORES OF PUPILS WHO DID AND WHO DID NOT ATTEND KINDERGARTEN

by

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The State of Tennessee has funded a voluntary kindergarten program in its public schools since 1970. The portion of kindergarten age children who have been enrolled in the program has increased considerably over the past nine years. Of those children who entered first grade in public schools in 1971, 18.5% of them had attended public kindergarten the previous year. The comparable figure for 1979 was 82.2%. During the first decade of the availability of a public kindergarten program in Tennessee, no data have been collected to ascertain the association between children's kindergarten attendance and subsequent achievement or progress through the school program.

With more than 80% of kindergarten age children now attending kindergarten, educational advantages of the program beg for justification in the minds of legislators, other state government officials, and a sector of the public. On the other hand, there are organizations and individuals who advocate a kindergarten program that would be mandatory for all children prior to entering first grade. This research represents the first effort by the State Department of Education to collect evidence to help answer the question.

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Beginning with the graduating class of 1982, all high school students in Tennessee will be required to pass a proficiency test in basic skills as a requisite for graduation. Preliminary proficiency tests were administered to all eighth grade pupils in 1978, 1979, and 1980. Since the same test was administered to all eighth grade pupils in the state in a given year, Tennessee was in a unique position to collect a common base of data for studying the association between pupil achievement in basic skills and the attendance of pupils in kindergarten. Our review of the literature suggests that Tennessee may be the only state that has collected such a massive quantity of data on the kindergarten question on a statewide basis. Other research studies, though sound in design and basically adequate in numbers of subjects, were limited in numbers of subjects compared with the number of pupils included in the present study. Because they were carried out on a smaller scale, however, some of the studies were able to control for certain variables, such as socioeconomic status, that was not possible in our study. For this reason, a comparison of the findings of other studies with those of the present study would appear to be especially important.

Review of Related Literature

Several research studies lend credence to the hypothesis that preschool or kindergarten experience directly influences later achievement. Begle (1979, p.71) reviewed fifteen such studies and reported that, while the studies are not unanimous in their findings, they do suggest that preschool experience leads to better mathematics achievement in the early grade. It is unclear, he observed from these studies, just how long this advantage lasts.

Haines (1960) studied two groups of children in Connecticut. One group was from a community without a kindergarten program. The second community, which had a kindergarten program that had been in operation for several years, was similar to the first community with respect to size, location, and history. Tests of reading and mathematics achievement were administered to all pupils in grades one through six. When it was discovered that pupils from the two communities were not comparable in mental ability, pupils were matched on the basis of mental ability to form pairs, reducing the initial population of over 800 subjects to 603. It was found that the group with kindergarten experience scored higher in reading than did the group without kindergarten experience, but the difference between groups was not statistically significant. Mathematics scores were higher in all grades for pupils with kindergarten experience, but they were significantly different (at the 0.01 level) from scores of pupils without kindergarten experience only in grades two and five. These findings suggest that the advantage in mathematics achievement that is associated with kindergarten persists up through the fifth grade at least. They further suggest that the effects of kindergarten experience may be stronger in influencing achievement in mathematics than in reading. As will be seen later, the results of our present study are similar.

Lazar and Darlington (1980) report the findings of the Consortium of Longitudinal Studies regarding the effectiveness of Head Start and similar preschool programs. Twelve investigators pooled data from their previous investigations, all carried out during the 1960's, and then designed a common follow-up study to analyze the effect of preschool experience on later achievement. They reported:

(1) Early education programs significantly reduced the number of children assigned to special education classes. This result held after controlling for the effects of children's IQ scores, sex, ethnic background, and family background. The benefit extended to all participants regardless of initial abilities or early home backgrounds.

(2) Early childhood programs significantly reduced the number of children retained in grade. The result held true when measures of early childhood characteristics and home background variables were controlled. All children benefitted, regardless of sex, ethnic background, early IQ, and home background.

(3) Early education significantly increased children's scores on fourth grade mathematics tests, and evidence suggested a trend toward increased scores on fourth grade reading tests.

Evidence from Coleman's study (1966), Mayeske's study (1967), and the Tennessee Study, Tennessee Looks at Its Schools: 1977-78, suggests that pupils who enter first grade with relatively high levels of development carry with them an advantage which, if sustained throughout the school years, would account for a fair amount of variation in achievement by the end of the high school years.

For more than 17 years, Weikart (1979) and his colleagues have conducted a longitudinal study of children who participated in the Perry Preschool Project in Ypsilanti, Michigan. The project was designed to determine whether preschool experience benefits disadvantaged children. Children were selected for study on the basis of family socioeconomic status (low) and IQ scores of 85 or lower, as measured by the Stanford-Binet Intelligence Scale. Children entered the study in five successive, overlapping waves of about 25 children each, beginning in the fall of 1962. Each wave was divided by matching pairs into a group that attended preschool for two years and a group that did not. Each wave of pupils was followed through grade eight. The Stanford-Binet was administered at the end of each school year up through grade four, and the Wechsler Intelligence Scale was given at the end of the eighth grade (It was

judged to be more suitable for older children than the Binet.) The California Achievement Test was given at the end of each school year through the fifth grade and also at the end of the eighth grade. Teacher ratings of pupils' social and emotional maturity were collected annually through the third grade. By spreading the sample over five years and by analyzing each of the waves separately, the authors claim they were able, in effect, to replicate the study five times. They reported the same positive effects for each of the five analyses, to wit:

(1) The IQ gains by the experimental group diminished until they matched those of the control group by the end of the third grade. Studies of Head Start children have demonstrated similar results.

(2) In the early grades, differences in achievement between the experimental and control groups were slight, but the differences increased over time. By the end of the eighth grade, the experimental group tested the the equivalent of more than one full grade higher than the control group. The experimental group scored significantly higher than the control group on all three sub-tests -- reading, language, and mathematics.

(3) By the end of the fourth grade, more than twice (38% versus 17%) as many children from the control group as from the experimental group had been retained in a grade or placed in special education classes.

(4) Teacher ratings of children's social and emotional maturity consistently favored children with preschool experience up through the third grade, the last year for which ratings were made. Teachers reported preschool children to be less disruptive, less resentful of criticism, more honest and more friendly than children without preschool experience.

(5) A cost analysis of the project indicated that the savings realized by the reduction in special placements of the preschool children represented a 56% return on the original investment in the project. The authors estimate that the projected, increased lifetime earnings of the preschool children are substantially higher than the entire cost of providing the preschool education.

It may be that the positive effects of preschool experience may be considerably stronger for children from disadvantaged/low SES family backgrounds than for children from family backgrounds that are middle class or above.

Weikart (1979) observed that preschool experience is by no means a cure-all. For while the preschool children in his study excelled their counterparts without preschool experience by 1.2 grade equivalents by the end of the eighth grade, they were still one full grade equivalent behind the achievement expected of children with the same IQ's. It is possible that children from families of middle-to-higher SES backgrounds bring with them to school an advantage in language and reading (even if only having been read to) that makes preschool experience less influential on their later achievement. The preschool experience of these same children within their family in mathematics, however, is likely to be more limited than it is in reading or in language. This hypothesis, if confirmed, could explain why studies of preschool experience of middle class children demonstrate a more positive effect on mathematics achievement than for achievement in reading and in language, whereas Weikart's study of disadvantaged children indicated strong positive effects for all three domains of achievement.

The findings from several investigations, reviewed above, point to an advantage of preschool educational experience or kindergarten that persists well into the elementary school, possibly up through grade eight or beyond. Several studies also indicate that the advantage of preschool experience or kindergarten may be stronger in its effect on achievement in mathematics than on achievement in reading.

Purposes of the Study

The purposes of this investigation were twofold: (1) to determine whether the Basic Skills Test scores of eighth grade pupils who attended

kindergarten differed from the scores of those who had not attended kindergarten; and (2) to determine whether the incidence of grade retention (non-promotion) of pupils who attended kindergarten differs from that of pupils without kindergarten experience.

Hypotheses of the Study

The null hypotheses of the study were as follows:

(1) The mean score on the eighth grade Basic Skills Test of pupils who attended kindergarten does not differ from that of pupils who did not attend kindergarten.

(2) The incidence of retention in grade (non-promotion) does not differ for pupils with kindergarten experience and for those without kindergarten experience.

Collection of Data

Data to test the first hypothesis were collected when the Basic Skills Test was administered to over 64,000 eighth grade pupils in the public schools of Tennessee in April, 1980. On each test answer sheet, a pupil taking the test was asked to respond to the question, "Did you attend kindergarten?" by blackening a circle labeled "Yes" or one labeled "No." The typical eighth grader in 1979-80 was of age for kindergarten attendance in the school year 1971-72.

The score of each pupil was reported by the Tennessee Testing and Evaluation Center as the number of test items answered correctly. Separate mean scores were reported for each of the four sub-tests -- mathematics, spelling,

language, and reading. Separate mean scores on each sub-test were determined for all pupils who attended kindergarten and for those who did not. For purposes of statistical analyses, the standard deviation associated with each mean was also determined so that a t-test could be carried out to test the hypotheses that no differences exist between means on each of the sub-tests.

Data to test the second hypothesis were collected in connection with a separate research study, which had to do with determining the association between various school-related factors and pupil achievement in mathematics. There is reason to believe, however, that the pupils and schools involved in this researdh study were reasonably typical of pupils and schools throughout the state with respect to achievement in basic skills and to kindergarten attendance.

The study of mathematics achievement involved 48 schools in 20 school systems and nearly 6,000 pupils in grades five through eight. Schools in the study were selected on the basis of their mathematics achievement scores. One set of schools had mean mathematics achievement scores that were significantly higher than the state mean; mean scores for the other set of schools were significantly below the state mean. Collectively, however, the mean mathematics scores of all schools in both sets did not differ from the state mean mathematics score. Schools were matched on the basis of equivalent mean scores in reading and also in language, and the means of the two sets of schools on these two sub-tests did not differ from the state mean. Of the nearly 6,000 pupils in the mathematics study, 65.6% of them attended kindergarten; 66.0% of all eighth grade pupils throughout the state in 1980 reported having attended kindergarten. It appears that the pupils involved in the

mathematics study did not differ from the state population of their counterparts with respect to achievement, as measured by the Basic Skills Test, or with respect to kindergarten attendance. Hence, using the subjects of that study as a representative sample of the state population appears to present no problem.

Findings of the Study

Data used to test the first hypothesis are presented in Table 1. The mean scores, their differences, the standard deviations, the t-values associated with the differences, and the statistical significance of the difference are shown for each of the four sub-tests. Data collected to test the second hypothesis are presented in Table 2.

Table 1

Achievement Data on Pupils With and Without Kindergarten Experience

Sub-test	Possible Score	Attended Kindergarten Mean	Attended Kindergarten S.D.	Did Not Attend Kindergarten Mean	Did Not Attend Kindergarten S.D.	Difference in Means	t-value*	Significance
Mathematics	76	54.36	15.31	51.07	15.57	3.29	25.5	<.001
Spelling	24	19.47	4.24	18.71	4.70	0.76	12.3	<.001
Language	56	38.12	11.00	35.44	11.20	2.68	29.0	<.001
Reading	44	36.30	7.64	34.83	8.36	1.47	21.7	<.001
Total Test	200	148.25	**	140.05	**	8.20	**	**
Number of Pupils		42,588		21,948				
Percent of Pupils		66.0%		34.0%				

* A t-value of only 3.3 was necessary to reject the null hypothesis at the 0.001 level of significance.

** Standard deviations for total score were not requested from the Testing and Evaluation Center because our primary interest was with differences in sub-test mean scores. A t-value for total score could not be determined because standard deviations were not available. There can be little doubt, however, that the difference in means for total test is also significant at the 0.001 level of significance.

Table 2

Actual and Expected Incidence of Grade Retention
Among Pupils Who Did and Who Did Not
Attend Kindergarten

Retention Status	Frequency	Attended Kindergarten: Yes	Attended Kindergarten: No	Total
Retained in at Least One Grade	Actual	639	595	1,234
	Expected	809	425	1,234
Never Retained in Grade Level	Actual	3,162	1,399	4,561
	Expected	2,992	1,569	
TOTAL		3,801	1,994	5,795

A chi-square test for the difference in the incidence of retention of pupils who did and who did not attend kindergarten yielded a chi-square value of 131.8. A value of only 10.8 is required (with one degree of freedom) to reject the null hypothesis at the 0.001 level of significance.

Discussion of Results

Achievement and Kindergarten Attendance

On the surface, differences in the mean scores on the eighth grade Test of Basic Skills of pupils who did and who did not attend kindergarten appear not to be great (see Table 1). However, one must keep in mind that the means represent the scores of over 42,000 pupils who attended kindergarten and of nearly 22,000 who did not. From a statistical point of view, the results are

highly significant; t-values varied from three to nine times greater than was necessary in order to reject the null hypothesis at the 0.001 level of significance. From a practical point of view, the difference in the mean scores for the total test was 8.2 test items. Simple calculation reveals that pupils who attended kindergarten correctly answered, collectively, almost 350,000 test items more than they would have if their scores had not differed from those of pupils without kindergarten experience (8.2 test items x 42,588 kindergarten attendees). The mean total test score of pupils with kindergarten background was approximately 6% higher than that of pupils without kindergarten.

Up to this point, no causal relationship has been inferred between test score differences and kindergarten attendance. Indeed, caution is called for in drawing such an inference. Two hypotheses come to mind that may account for differences in test scores:

> Hypothesis A: Test score differences are the effects of gains in cognitive, affective, and motor skill development that result from kindergarten experience.
>
> Hypothesis B: Test score differences are the effects of socioeconomic status; that is, the effects of the nurturance, encouragement, and the value placed on educational achievement, all of which are typically more characteristic of homes of higher socioeconomic status than of homes of lower socioeconomic status.

Evidence that is presently available is insufficient to establish the validity of either hypothesis. It is probable that the effect is in part explainable by both hypotheses.

It has been argued that parents who place high value on educational achievement and who are convinced of the value of preschool learning experiences are more likely than others to provide the kindergarten option

for their children. Some of these parents may have paid tuition for private kindergarten because of geographical convenience or lack of availability (in 1971-72) of a public kindergarten program. In 1971-72 it was necessary in many school districts for parents to provide private transportation for their kindergarten children. These efforts required a commitment to the value of preschool education. And the parents who made these efforts are likely also to be ones who nurture, encourage, and instill in their children the values that contribute to educational achievement throughout their school careers.

There is clearly an argument in favor of the socioeconomic hypothesis. The argument is weakened, however, by the fact that 66% of the total eighth grade population attended kindergarten. The upper and upper-middle socio-economic classes of families represent far less than two-thirds of all families in Tennessee. Undoubtedly, part of the advantage held by kindergarten attendees eight years after attending kindergarten is due to the developmental gains made during their kindergarten experience.

Unmeasured Effects. The achievement of eighth grade pupils across the state was measured solely in terms of 50 basic skills objectives which the Basic Skills Test was designed to measure. One may assume that any main effects of kindergarten experience extend to learning domains beyond those 50 objectives. Tennessee has defined 80 basic skills objectives, but tests at a given time only 50 of them (four test items per objective) selected at random from among the 80 objectives. Thus, one may assume that pupils who attended kindergarten hold some advantage over those who did not on the 30 unmeasured objectives. Additionally, local schools teach for a broad range of objectives beyond the 80 basic skills objectives defined by the state as

minimum. Again, one may assume that any advantage accruing to pupils with kindergarten experience extends, to some extent at least, into that broad domain of objectives. In short, the results of the Basic Skills Test almost surely represent only a small sample of the potential benefits that may be realized as a result of kindergarten attendance.

Retention and Kindergarten Experience

Pupils who attend kindergarten in Tennessee are retained in grade with an incidence that is significantly lower than that of their peers who did not attend kindergarten. Of those pupils in our sample who attended kindergarten, 17% of them failed to be promoted in at least one grade, whereas 30% of those pupils who did not attend kindergarten were retained in at least one grade. Conversely, of those who attended kindergarten, 83% were never retained in grade, but only 70% of the non-kindergarten pupils were never retained. From a separate projection study, our estimate is that, on a statewide basis, over nine thousand more non-promotions have occurred among the Grade 5-8 population of non-kindergarten pupils of 1979-80 during the course of their school careers than would be expected if their retention rate were the same as that of kindergarten pupils.

Financial and Psychological Costs

Any consideration of the costs and benefits of a compulsory kindergarten program must take into account the eventual and considerable offset in costs that is presently incurred by the greater-than-expected grade repetitions by children without kindergarten education. The cost of the differential retention incidence is estimated to be about 2.5 million dollars annually in Tennessee at the present time. Additionally, as was shown in Table 1, one must consider that the school achievement of pupils with kindergarten background is superior

to that of non-kindergarten pupils. The advantage in achievement held by kindergarten attendees would appear to be exceptionally strong in the early grades for its effects still to be statistically significant by the end of the eighth grade. One might expect the effects of kindergarten development to diminish somewhat with time for some pupils; at the same time one might expect many non-kindergarten children of average or above-average ability to catch-up or close the achievement gap between themselves and some of their kindergarten peers over the course of eight years of elementary school education. It should be noted, however, that in his study of children with and without preschool education, Weikart (1979) found that the achievement gap between the two groups increased as they progressed through the elementary school grades.

A further advantage of increasing the prevalence of kindergarten education is immeasurable, but of utmost significance. To the extent that kindergarten experience results in improved achievement and reduces the need for pupils to be "failed," to that extent it can help reduce the incalculable psychological damage to our children--the damaging scars of lowered self-esteem, of feelings of unworthiness, of reduced motivation to achieve, of lowering of goals, of some abandonment of "can do" attitudes, and of some loss of feelings that the control of one's destiny rests to a large extent in one's own hands. The reduction of these psychological effects, the expected improvement in school achievement, and the offset in costs by the more than two million dollars now spent annually by Tennessee on "unnecessary" retention of pupils in grade--all of these speak convincingly to the need and justification of universal kindergarten attendance.

Summary

The results of the Basic Skills Test administered statewide to over 64,000 eighth grade pupils in April, 1980, demonstrate that achievement of pupils with kindergarten background is superior to that of non-kindergarten pupils in mathematics, in spelling, in language, and in reading. The effect was greatest for mathematics and for language, less for reading and spelling. The test assessed achievement with respect to 50 of the 80 objectives defined by the state as minimal basic skills competencies. One may assume some advantage on behalf of kindergarten attendees on the 30 unmeasured objectives and on a broad domain of objectives extending beyond the 80 basic skills objectives.

A separate study of a sample of nearly 6,000 pupils, grades five through eight, revealed that the incidence of retention in grade (non-promotion) is considerably less for pupils with kindergarten background than for pupils without it. Our estimate is that statewide over nine thousand more retentions have occurred among the Grade 5-8 population of non-kindergarten pupils (of 1979-80) during their school careers than would be expected if their retention rate were the same as that for kindergarten pupils. The cost of the differential retention incidence is sizeable, estimated to be nearly 2.5 million dollars annually in Tennessee. Any consideration of the costs and benefits of a compulsory kindergarten program must take into account the eventual and considerable offset in costs that is presently incurred in funding the greater-than-expected grade repetitions by pupils without kindergarten education. It must also take into account the superior achievement of pupils with kindergarten background and the reduction in psychological damage to pupils whose "failures" may be averted.

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